AMENDMENT NO. 1 TO AGREEMENT TO PROVIDE PROFESSIONAL SERVICES FOR DAM INSPECTIONS, MAINTENANCE AND REHABILITATION BETWEEN THE CITY OF DURHAM AND SCHNABEL ENGINEERING SOUTH, P.C.

This contract amendment ("Amendment") is dated and entered into as of the _____ day of _____, 20_____, between Schnabel Engineering South, P.C. a professional corporation organized and existing under the laws of the State of North Carolina, (hereinafter referred to as the "Engineer") and City of Durham (hereinafter referred to as the "City").

The City and the Engineer entered into a contract titled "Agreement to Provide Professional Services for Dam Inspection, Maintenance and Rehabilitation between the City of Durham and Schnabel Engineering South, P.C." dated December 15, 2014. That contract is referred to as the "Original Contract". The Original Contract provided for professional consulting services for dam safety inspections, document updates, condition assessment, and development of a 50-year plan for repair and maintenance of dam and pump station facilities, and various engineering evaluations for rehabilitation projects, for a total potential contract amount of $986,542.00.

INTRODUCTION

Inspection Tasks (Phase 1) were authorized for a five-year period, and are still ongoing under the Original Agreement. The Condition Assessment and Rehabilitation Plan (Phase 2) is complete, and the Preventive Maintenance Procedures (Phase 3) tasks are nearing completion. Engineering evaluation tasks (Phase 4) are ongoing. The scope of work in this Amendment (Amendment 1) includes Phase 5 – Lake Michie Dam Additional Evaluation and Analysis, and Phase 6 – Little River Dam Additional Evaluation and Analysis.

The Condition Assessment and Rehab Planning conducted under the Original Agreement resulted in the need for additional evaluation and analysis in order to determine the extent of rehabilitation needed, and to inform the preliminary engineering and design processes for the rehabilitation projects identified for Lake Michie Dam and Little River Dam.

The Original Agreement is amended and supplemented by incorporating the following additional items:

1) Article 8 – EXHIBITS AND SPECIAL PROVISIONS:

    a) Article 8.02. I. - **Iran Divestment Act Certification.** The City of Durham certifies that, as of the date that this contract is entered into, the City of Durham is not on the Final Divestment List. The List is issued by the N.C. State Treasurer to comply with N.C.G.S.

143C-6A-4 of the N.C. Iran Divestment Act. This Iran Divestment Act Certification section applies only if this contract requires the City of Durham to provide goods or services. The City shall not utilize on this contract any subcontractor that is identified on the List.

b) E-Verify Requirements. (a) If this contract is awarded pursuant to North Carolina General Statutes (NCGS) 143-129 – (i) the contractor represents and covenants that the contractor and its subcontractors comply with the requirements of Article 2 of Chapter 64 of the NCGS; (ii) the words "contractor," "contractor's subcontractors," and "comply" as used in this subsection (a) shall have the meanings intended by NCGS 143-129(j); and (iii) the City is relying on this subsection (a) in entering into this contract. (b) If this contract is subject to NCGS 143-133.3, the contractor and its subcontractors shall comply with the requirements of Article 2 of Chapter 64 of the NCGS.

2) Insert the following additional tasks at the end of Attachment to Exhibit A:

Phase 5 – Lake Michie

Task 5-1 - Survey

- ENGINEER shall obtain a survey subcontractor to perform a survey of the dam to define the topography of the crest at the overflow section of the spillway, location of vertical joints, and the terrain within 100 feet in all directions of the spillway, excluding the reservoir.
- ENGINEER's survey subcontractor work shall be performed under the responsible charge of a registered Professional Land Surveyor.
- The project datum will be based on the North Carolina State Plane Coordinate System NAD 83(2008). Vertical datum will be based on NAVD 88.
- ENGINEER's survey subcontractor will perform topographic and planimetric surveys sufficient to produce 1 foot contours along the length of the project. Contours in some areas such as the western slopes on the west side of the roadway and dam and the topographic surveys 100 LF from the toe of the dam may not produce satisfactory contours because of the very irregular rock but these areas will have spot shots at a minimum. ENGINEER's survey subcontractor will survey the size and location of two plugged drain holes at the toe of the non-overflow section.
- ENGINEER's survey subcontractor will locate 2 piezometers and 11 vertical drains inside the Gallery.

- ENGINEER's survey subcontractor will locate 4 horizontal drains at the toe of the spillway overflow section and all expansion joints in both the overflow and non-overflow sections.

- ENGINEER's survey subcontractor will survey the crest of the non-overflow section at the right side and left side all corners and at a 40 foot spacing in between.

- ENGINEER's survey subcontractor will survey 5 feet minimum width, measured upstream to downstream, centered about crest of overflow spillway at both ends. Survey will contain a minimum of five points.

- CITY will provide access through gates to the dam and gallery. Survey subcontractor will be responsible for coordinating any access needed through the City of Durham Police range.

- ENGINEER's survey subcontractor will merge the survey performed in this task with its previous survey at the left abutment. The ENGINEER's survey subcontractor will prepare a single planimetric file incorporating these two surveys.

- ENGINEER's survey deliverables to CITY will include an electronic two-dimensional pdf file of the survey signed and sealed by a registered North Carolina Professional Land Surveyor, an AutoCAD digital file containing the survey data, and a survey report describing the digital survey and the horizontal and vertical datum used signed and sealed by a registered North Carolina Professional Land Surveyor.

Task 5-2 – Lake Michie Drain Cleaning

- ENGINEER shall obtain a drain cleaning subcontractor to flush the four, 6-inch horizontal drains that outlet at the toe of the overflow spillway. The ENGINEER's drain cleaning subcontractor will also flush eleven, 6-inch diameter drains accessible from within the Gallery. The drains will be inspected using a downhole camera to the extent possible before and after cleaning and will be recorded digitally. No chemicals shall be used during drain cleaning.

- ENGINEER's drain cleaning subcontractor shall furnish all labor, equipment, and supervision which may be necessary to complete this task, including a jetter capable of 4,000 psi at 18 gallons per minute with an assortment of nozzles, a CCTV mini-cam equipped for digital recording, a small generator/inverter filtered for power supply with the CCTV and computer, rigging and ropes to locate jetter hose to the toe of the dam, a pump and all hose needed to fill the jetter tank, and necessary utility trucks.

- ENGINEER will provide onsite oversight and recommendations of the drain cleaning.

- The extent of the drain clogging and the ability to flush the drains is unknown and dependent on the type and extent of the drain cleaning. The level of effort assumed in this task for the ENGINEER and ENGINEER's drain cleaning subcontractor is four days onsite, working 8 hours per day. Any additional work necessary to clean the drains will be requested by the ENGINEER and must be authorized by the CITY prior to performing the work.

- CITY shall provide the ENGINEER and ENGINEER's subcontractor complete openings access and rights of way to the work area, an area to operate and clean the equipment, and the use of water supply from the tailrace for flushing operations.

- ENGINEER will prepare a technical memorandum documenting the observations from the cleaning process and include any additional recommendations. ENGINEER will provide the CITY with digital recording of drain cleaning performed by ENGINEER's drain cleaning subcontractor.

Task 5-3 – Lake Michie Incremental Damage Analysis to Determine Design Storm

Engineering services will include performing detailed hydrologic analyses of the watershed, reservoir and dam hydraulic analyses, and downstream hydraulic analyses to perform an Incremental Damage Analysis (IDA) to establish the Standard Design Storm (SDS) for Lake Michie.

- ENGINEER shall review and refine the preliminary hydrologic analyses performed as part of Phase 2. This will include looking at regional stream gage data and considering future watershed conditions. ENGINEER shall calculate the runoff from frequency storms ranging from the 5-year to the 500-year storm in addition to the ½ and ¾ Probable Maximum Precipitation (PMP) previously calculated.

- ENGINEER will use the reservoir model previously developed under Phase 2 and update the spillway and dam information based on the survey (see Task 5-1) as appropriate. This includes a review the downstream hydraulic model previously developed. ENGINEER will use these models to perform the IDA in accordance with the current Federal Guidelines for Dam Safety outlined in Selecting and Accommodating Inflow Design Floods for Dams (FEMA, 2004). ENGINEER shall analyze selected storm events ranging from the ¾ PMP to the ½ PMP. This analysis will evaluate the incremental difference between the proposed flood conditions with and without dam failure at hazard locations downstream of the dam. If ENGINEER determines that an IDA is applicable to

Lake Michie Dam, ENGINEER will contact NC DEQ Dam Safety and provide them with the necessary information to approve a reduction in the SDS for the dam.

- ENGINEER shall evaluate the existing spillway to establish if the spillway has the capacity to pass the SDS. If the spillway does not have capacity, ENGINEER will evaluate raising the earthen embankment, adding overtopping protection below the left side of the concrete dam (which will overtop) or a combination of raising the dam and overtopping protection. ENGINEER will perform an evaluation of a maximum of two alternatives to address spillway inadequacy in order to develop a conceptual layout, preliminary estimate of probable construction costs, and a short discussion of other potential alternatives. ENGINEER will prepare a technical memorandum summarizing the results as the deliverable for this task.

- ENGINEER will attend a meeting with CITY to present and discuss the results of this task.

Task 5-4 – Lake Michie Subsurface Investigation and Instrumentation Installation – Vibrating Wire Piezometers

A subsurface investigation and materials testing program will be conducted to support the embankment stability analysis (Task 5-6), the design of repairs to the right tailrace wall (Task 5-7), and the spillway stability analysis and alternatives evaluation (Task 5-8). The plugs at the downstream end of the existing reservoir drain conduits will also be evaluated.

- ENGINEER will retain a drilling subcontractor to perform a subsurface investigation of the concrete spillway, embankment, abandoned reservoir drain pipes, and right tailrace wall. ENGINEER will provide a geotechnical engineer or engineering geologist to oversee the investigation program. The investigation will consist of soil drilling, rock and concrete coring, sampling and testing, rehabilitation of existing piezometers, and installation of new vibrating wire piezometers as described in the following sections. The ENGINEER anticipates that the field investigation will take approximately five weeks to complete.

- Prior to commencement of the investigation, ENGINEER and their drilling subcontractor will participate in a meeting with the City to discuss the investigation work plan and the location of utilities. Agenda, facilitation, and meeting minutes will be provided by the ENGINEER.

- ENGINEER will contact North Carolina 811 prior to mobilizing any drilling or excavating equipment to the project site. North Carolina 811 will contact the appropriate public utility companies (or their contract locators) to mark their utilities on the project

site. Between 48 and 72 hours are typically required to clear utilities on a site. ENGINEER will not be responsible for damage or disruption of utilities or other subsurface features not indicated to ENGINEER in advance. The public utility companies will not mark private utilities on a site. Location of private utilities is the responsibility of the Property Owner according to North Carolina 811.

- If any additional investigation or testing is required beyond that outlined herein, ENGINEER will request approval for the additional scope and fees prior to proceeding.

Embankment Borings and Test Pits

- ENGINEER's drilling subcontractor will drill three borings along the left embankment. Boring EB-01 will be drilled along the crest of the embankment just downstream of the existing concrete core wall, and Boring EB-02 will be drilled at the downstream toe of the dam in line with Boring EB-01. Boring EB-03 will be drilled in order to replace the existing open standpipe piezometer just downstream of the left non-overflow section at the toe of the embankment. These borings will be drilled through soil and cored at least 15 feet into rock. Packer testing will be performed in rock in all three borings. New vibrating wire piezometers will be installed in each boring.
- ENGINEER's drilling subcontractor will excavate at least two test pits along the crest of the embankment to help define the depth to and extent of the existing concrete core wall. Upon completion, the test pits will be properly backfilled with the excavated soils.
- ENGINEER's drilling subcontractor will excavate one test pit in the area of the existing 8-inch diameter ductile iron pipe on the downstream slope of the left embankment. If the pipe is determined to be abandoned, it will be removed or plugged.

Spillway Monoliths

There are four spillway monoliths, designated as M-1 through M-4 from right to left. There are two existing ½-inch diameter open standpipe piezometers in spillway monoliths M-2 and M-3 that extend from the inspection gallery into the rock foundation. It is unknown if these piezometers are functioning properly and providing an accurate representation of the water pressures within and beneath the spillway. As described below, two borings and two new vibrating wire piezometers will be installed in the spillway regardless of the functionality of the existing piezometers due to potential concerns with the long-term viability of the existing piezometers. The location of the borings and vibrating wire piezometers will be finalized once the effectiveness of the existing piezometers has been evaluated.

- ENGINEER will install pressure gauges on the two existing piezometers and the pressures will be recorded. Following the pressure readings, ENGINEER's drilling

subcontractor will flush these piezometers in an attempt to rehabilitate them. If it is determined that flushing is ineffective, the existing piezometers P-1 and P-2 will be filled with cement-bentonite grout, and two borings will be drilled adjacent to the existing piezometers in spillway monoliths M-2 and M-3. The borings will be cored from the inspection gallery through the concrete spillway and at least 15 feet into the rock foundation. Packer testing will be performed in rock in both borings. In addition, new vibrating wire piezometers (SP-01 and SP-02) will be installed in the borings.

- If flushing of the existing piezometers P-1 and P-2 is determined to be effective, ENGINEER's drilling subcontractor will drill two borings through spillway monoliths M-1 and M-4, and new piezometers SP-01 and SP-02 will be installed in these borings as described above.

Left Non-Overflow Monoliths

- ENGINEER's drilling subcontractor will drill one boring from the crest of the left concrete non-overflow section at least 15 feet into the rock foundation. Packer testing will be performed in rock, and an open standpipe piezometer will be installed in boring NO-01.

Vibrating Wire Piezometers

- The vibrating wire piezometers installed at the locations noted below in this task will consist of Geokon Model 4500S unvented instruments or an approved equivalent. The piezometers will be grouted in the boreholes, and the vibrating wire cables would be routed in PVC conduit from the boreholes through the embankment and/or inspection gallery to a datalogger in the pumphouse. The datalogger will be connected to a permanent electrical power source in the pumphouse, and the datalogger will record piezometer readings at a set frequency agreed upon by the CITY. The datalogger would then be downloaded on a regular basis so the piezometer readings could be evaluated.

Reservoir Drain Conduits

The 72-inch and 36-inch diameter original reservoir drain conduits have been plugged based on visual observation along the downstream face of the spillway. There are no available construction records to evaluate the extent or quality of the abandonment.

- ENGINEER's drilling subcontractor will drill small exploratory holes (i.e., less than one-inch diameter) up to four feet deep to define the horizontal extent of the plugs. If the plugs extend beyond a depth of four feet, the small exploratory holes will be filled with a cementitious grout. If the depth of the plug(s) is less than four feet, a 6 to 12-inch diameter hole will be cored through the approximate center of the plug to allow for visual inspection of the abandoned drain pipes. Upon completion of the visual inspection, the core holes will be backfilled with a cementitious grout and/or high strength concrete.

Right Tailrace Wall

During the underwater inspection performed by Glenn Underwater Services on April 14 and 15, 2015, the right (west) concrete tailrace wall was observed to be partially undermined. Since there are no construction drawings or records available for this wall, ENGINEER will perform an investigation to evaluate the general construction and foundation conditions of the undermined tailrace wall in order to support the design of repairs to the wall (Task 5-7):

- ENGINEER's drilling subcontractor will drill one boring through the top of the tailrace wall into the rock foundation. No piezometer will be installed in this boring. However, temporary water levels will be obtained in this boring. The boring will be backfilled with cement-bentonite grout upon completion.

- ENGINEER's drilling subcontractor will drill one boring in the grass area behind the wall. This boring will be drilled through soil and terminated at the top of rock. No piezometer will be installed in this boring. However, temporary water levels will be obtained in this boring. The boring will be backfilled with cement-bentonite grout upon completion.

Laboratory Testing

- ENGINEER will perform laboratory tests on select samples of the embankment soils obtained during the investigation in order to determine the index properties and mechanical characteristics of the soils for use in analysis and design. Soil laboratory testing will be performed by ENGINEER's laboratory in Blacksburg, Virginia. The following types and numbers of tests will be performed:
    - Twelve moisture content tests (ASTM D2216)
    - Two natural density and moisture content tests (ASTM D7263)
    - Eight Atterberg Limits tests (ASTM D4318)
    - Four mechanical analysis tests – sieve only (ASTM D422 and D1140)
    - Four mechanical analysis tests – sieve and hydrometer (ASTM D422 and D1140)
    - Four specific gravity tests (ASTM D854)
    - Two consolidated-undrained triaxial compression tests (ASTM D4767)
    - Two permeability of fine-grained soils tests (ASTM D5084)

- ENGINEER will design a material testing program to evaluate the material properties to be used in the structural stability analysis. ENGINEER will provide oversight of the drilling operations to observe drilling conditions encountered and to collect the log core samples retrieved from drilling operations. ENGINEER will coordinate material testing of representative samples of the concrete and rock foundation. ENGINEER will secure a subconsultant to perform the testing. If core recovery allows, lab testing will include the following samples:
    - Three unconfined compressive strength tests of concrete core from spillway

- Three unconfined compressive strength tests of rock core below spillway, including determination of modulus of elasticity and Poisson's ratio
- One unconfined compressive strength test of tailrace wall concrete core
- One unconfined compressive strength test of rock core below tailrace wall
- Unit weight testing for each compressive strength test
- Three splitting tensile tests of concrete core
- Three direct tension tests of concrete at lift lines
- Two direct shear tests along spillway concrete lift lines
- Two direct shear tests of the plum stones at lift lines
- Two direct shear tests along the spillway concrete-to-rock interface
- Three direct shear tests along discontinuities in the foundation rock

Geotechnical Data Report

- ENGINEER will prepare a Geotechnical Data Report (GDR) to include the results of the subsurface investigation and associated testing. The GDR will also include a description of the project and local geology.

Training

- ENGINEER will conduct an onsite training session on the vibrating wire piezometers for the CITY. The training session will cover maintenance requirements and instructions for downloading and evaluating instrumentation readings.

Task 5-5 - Lake Michie Sluice Gates No. 1 and 2 Abandonment Analysis

Lake Michie Dam was originally constructed with two sluice gates used as reservoir drains. Sluice Gate 1 is 36 inches in diameter while Sluice Gate 2 is 72 inches. The reservoir drains are currently out of service and are inoperable. The conduits are plugged based on visual observation of the downstream face. An operable reservoir drain is a requirement of the North Carolina Administrative Code.

- Lake Michie also has three bays (Bays 1, 2 and 3) at the headgate on the upstream face of the non-overflow section of spillway and Pumping Station. Each bay has four sluice gates: a 42-inch, a 60-inch, and two 12-inch gates. The 60-inch sluice gates, which are located at the inlet to the flumes feeding the scroll casing of the old hydraulic turbines, may potentially be used as a reservoir drain. ENGINEER will perform hydraulic analysis

of the existing conditions of the sluice gates located in Bays 1, 2 and 3 to determine the drain rate to draw down the reservoir. The hydraulic analysis will consider a new elbow directing flow downward through the Pump Station floor into the tailrace. The analysis will include potentially using one of the 60-inch sluice gates located in Bays 1, 2, or 3.

- ENGINEER will perform hydraulic analysis of the proposed conditions and consider any hydraulic losses that may impact the effectiveness of the drain system.

- If recommendations to abandon the existing reservoir drains are acceptable by the OWNER, and, if coring through the plugs on the downstream face reveals that the conduits are empty, the ENGINEER will then develop a conceptual plan to properly abandon the existing reservoir drains.

- ENGINEER will create concept sketches and a cost estimate for the design to abandon the existing reservoir drains and properly plug the reservoir outlet penetrations. ENGINEER will prepare a technical memorandum documenting the results of the analysis and include any additional recommendations.

- If the 60-inch sluice gates are determined to be inadequate for a reservoir drain, the original 72-inch sluice gate will be evaluated for use as a reservoir drain. The 72-inch sluice gate option will be considered as an alternative only if the core drill investigation performed in Task 5-4 indicates that the conduit was not fully plugged at the face and not filled along the entire length of the conduit. No other alternatives will be considered in this Task.

Task 5-6 – Lake Michie Embankment Stability Analysis

- ENGINEER will perform an embankment slope stability analysis using the results of the subsurface investigation. ENGINEER will evaluate the stability of the embankment slopes under normal operating conditions, flood loading conditions, and seismic loading conditions in accordance with NC Dam Safety requirements.

- ENGINEER will prepare a technical memorandum summarizing the results of the slope stability analyses. The technical memorandum will include recommendations for additional studies and/or repair, if necessary.

Task 5-7 – Lake Michie Right Concrete Tailrace Wall Evaluation

- The Lake Michie right (west) concrete tailrace wall was observed to have been undermined during the underwater inspection performed by Glenn Underwater Services

on April 14-15, 2015. It is assumed that no construction drawings are available for the tailrace walls.

- ENGINEER will evaluate conditions based on data collected in Task 5-4, and develop a conceptual plan to repair the area downstream of the right concrete tailrace wall. It is anticipated that the conceptual plan will include dewatering the area, cleaning the rock foundation, and placing concrete anchored into the rock. ENGINEER will provide sketches for the conceptual repair and a technical memorandum summarizing the findings.

Task 5-8 – Lake Michie Spillway Stability Analysis and Evaluation of Alternatives to Meet Stability Criteria

Preliminary analyses conducted in Phase 2 indicated inadequate sliding stability factors of safety at lift lines near the base of the spillway such that the spillway requires strengthening measures.

- ENGINEER will perform updated stability analyses using data from the rehabilitation of piezometers performed in Task 5-4 and using hydraulic loads based on the new design storm developed in Task 5-3 to evaluate spillway stability and deficiencies.

- ENGINEER will model the geometry of the dam base at a maximum of 3 sections along the length of the dam based on the original as-built construction drawings provided by the CITY and the survey performed in Task 5-1.

- ENGINEER will consider seismic loads using ground motion hazard maps available from the United States Geological Survey (USGS), along with information from the subsurface investigation to estimate probabilistic ground motions that will be used to determine the seismic loads in the stability analysis. Thermal loads will not be considered.

- ENGINEER will evaluate post-tensioned steel anchors to address inadequate stability requirements using results of the material sampling program (Task 5-4) and the stability analyses. ENGINEER will estimate the required anchor loads and estimate the number of anchors and embedment depth for evaluation of a post-tensioned design concept.

- ENGINEER will perform a global stability analysis for applicable loads and load combinations. Material properties used in the analysis will be selected based on review of the material testing results in Task 5-4. ENGINEER will provide a report that includes a summary of the results of the analyses. The Pump Station structure will not be included in the stability analysis.

- ENGINEER will submit results of analysis and recommended alternative to North Carolina Department of Environmental Quality (NC DEQ) Dam Safety at the end of the analysis phase for their approval.

- ENGINEER will provide sketches of the conceptual layout including plan anchor locations and typical cross sections.

- ENGINEER will use results of stability analyses to determine the design basis values for the piezometer water levels. Actual drain efficiency will be evaluated from historical piezometer data (during the timeframe where the piezometers appeared to be functioning) and incorporated into establishing threshold values. An action plan when threshold levels are exceeded will be developed.

ENGINEER will attend up to two meetings with the CITY for this task. These meetings will include one meeting to review the progress of the work and one meeting to discuss the draft report.

Phase 6 – Little River

Task 6-1 – Little River Embankment Seepage and Stability Analysis

- ENGINEER will perform a transient seepage analysis to evaluate the effect(s) of a controlled reservoir drawdown on the piezometric surface in the embankment. The results of the transient seepage analysis will be used to update the rapid drawdown slope stability model developed in Phase 2 in accordance with NC Dam Safety requirements.

- ENGINEER will prepare a technical memorandum summarizing the results of the transient seepage analysis and updated rapid drawdown slope stability analysis. The technical memorandum will include recommendations for additional studies and/or repair, if necessary.

- ENGINEER will perform steady state and transient seepage analyses to develop design basis values for piezometer water levels. Threshold values for piezometers will be established based on historical levels and the results of the analyses. An action plan for when threshold levels are exceeded will be developed.

Task 6-2 – Little River Gate Operations and Flooding Analysis

- ENGINEER will review the current gate operations plan presented in Section 3.3 of the Operation and Maintenance Manual, and any available gate operations and reservoir level data. ENGINEER will meet with the dam operator to further discuss the current gate operations plan. The analysis will identify the inundation zone based on the gate

operations plan. The review will consider the flood impacts of operating gates for various storm events ranging from the 2-year frequency to the design storm.

- ENGINEER will use the information from the review to conduct a flooding analysis using HEC-RAS and incorporating the gate operations for various storm events. The results of this analysis will be used to provide an assessment of the current gate operations outlining the conditions (gate openings and reservoir inflows) in which structures are impacted. The deliverable for this task will be an updated gate operations plan.

- ENGINEER will attend one summary meeting with CITY to discuss analysis results and the updated gate operations plan.

- No remedial work on any assets or coordination with any asset owners is included in this task.

- Update of the Emergency Action Plan is not included in this task. Update of the Operation and Maintenance Manual is included in this task.

Task 6-3 – Little River Spillway Concrete Pier Condition Evaluation and Repair Plan

During the 2015 dam inspection performed in Task 1-1, the downstream face of the concrete pier between spillway gates 4 and 5 was observed to have pattern cracking and whitish-brown deposits that may be indicative of alkali-silica reactivity (ASR). These cracks are visible in the 1999 inspection report, which is the earliest available inspection report available for the dam. A recommendation to evaluate the potential for ASR in this concrete was included in the 2015 dam inspection report.

- ENGINEER will obtain one, three-inch diameter concrete core from the pier using handheld diamond bit coring equipment. The core will be drilled to a depth of about six inches. The reinforcing steel in the pier will be located prior to coring and avoided, to the extent possible. The core hole will be patched with high strength concrete upon completion.

- ENGINEER will perform a petrographic analysis on the concrete core to evaluate the potential for ASR.

- ENGINEER will prepare a technical memorandum summarizing the results of the coring and petrographic analysis. The technical memorandum will include recommendations for repair or further study, if applicable.

- No remedial work will be performed in this task.

Task 6-4 – Little River Tunnel Quarterly Inspections

- Phase 1 of this contract includes annual inspections of Little River Dam, including the tunnel which contains the 72-inch raw water conduit from the intake structure. In order to evaluate seasonal variations in leaks, sediment infiltration, other signs of distress inside the tunnel, and record gas levels in the tunnel, ENGINEER shall perform a total of three (3) quarterly inspections of the Little River tunnel as part of this contract amendment task.

- ENGINEER shall record readings from a four gas meter at each 25-foot station along the length of the tunnel (concrete conduit). This data will help the City determine whether or not the tunnel should be considered an oxygen deficient environment and whether or not the tunnel should be considered a permit required confined space.

- ENGINEER shall coordinate with City to obtain access to the tunnel.

- ENGINEER shall follow its own company safety plan for entry into the tunnel.

- ENGINEER shall provide City with gas meter readings from the inspection after each inspection. ENGINEER shall prepare an inspection report for each inspection documenting observed leaks, sediment infiltration, and other signs of distress.

Deliverables

Engineering reports, technical memorandums, and summary reports will be provided as part of the scope of this Amendment and are included within the individual tasks. ENGINEER will provide five copies of the draft and final versions of each deliverable to the CITY.

Assumptions

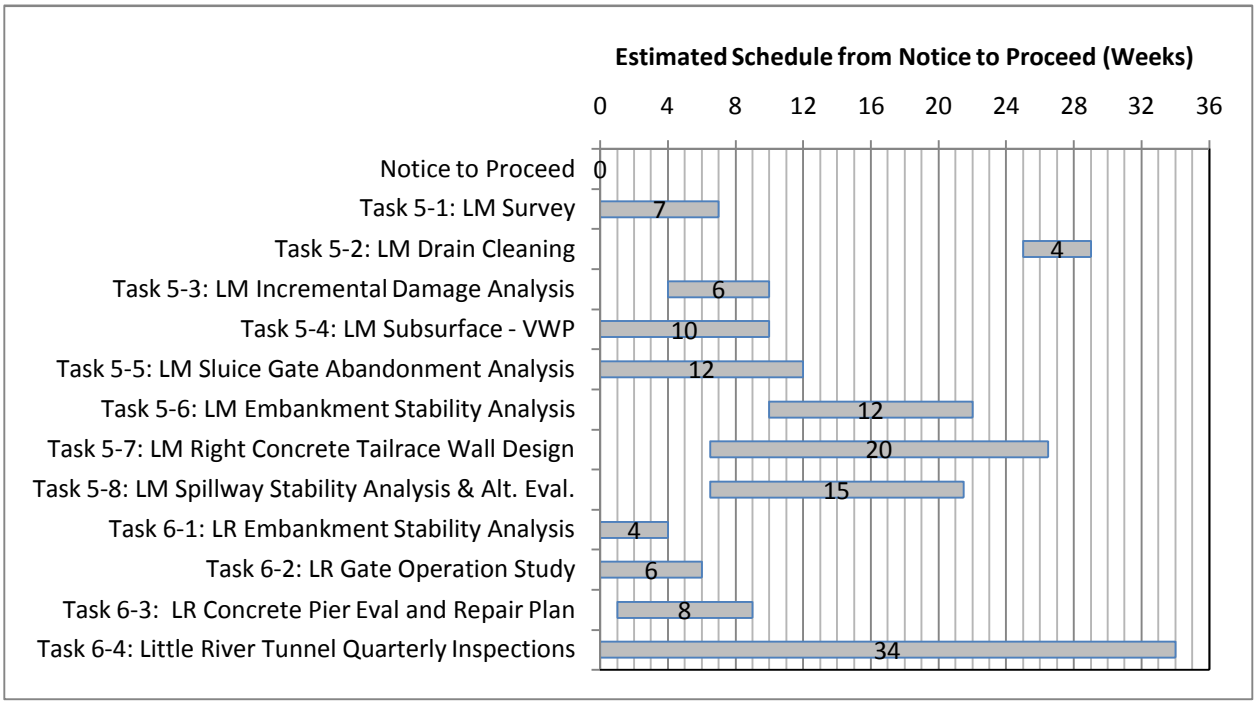
ENGINEER has made the following assumptions during the development of the proposal:

- It is assumed that the investigation work for Task 5-4 and 6-3 will be scheduled consecutively such that a single mobilization of a driller will be necessary.
- It is assumed that Task 5-1 work on site at the toe of the spillway will be performed when the spillway is not overtopping. If the site cannot be accessed, then the estimated schedule for Tasks 5-1, 5-3, 5-4, 5-5, 5-6, 5-7, and 5-8 will be delayed one day for each day the site is not accessible.

- It is assumed that Task 5-2 work on site at the toe of the spillway will be performed when the spillway is not overtopping. If the site cannot be accessed, then the schedule for Task 5-2 will be delayed one day for each day the site is not accessible.

SCHEDULE

ENGINEER estimates issuance of a draft of the last deliverable, Task 6-4, for CITY to review within about 34 weeks after receiving written notice to proceed. ENGINEER estimates submittal of final versions of this deliverable within about 3 weeks after ENGINEER receives review comments from CITY. The following schedule includes the estimated schedule starting with the notice to proceed.



BASIS OF COMPENSATION AND ESTIMATED FEE

CITY shall pay ENGINEER for services rendered under this Amendment on a Time and Materials basis in accordance with the attached Schedule of Personnel Fees with the overall fee not to exceed $610,000 without prior approval. A breakdown of the fee by task is summarized below.

Task Item	**Fee** **Time and Materials,**

	Not to Exceed
Phase 5 – Lake Michie	
Task 5-1 – Lake Michie Survey	$34,000
Task 5-2 – Lake Michie Drain Cleaning	$32,000
Task 5-3 – Lake Michie Incremental Damage Analysis to Determine Design Storm	$26,000
Task 5-4 – Lake Michie Subsurface Investigation and Instrumentation Installation – Vibrating Wire Piezometers	$302,000
Task 5-5 – Lake Michie Sluice Gates No. 1 and 2 Abandonment - Analysis	$27,000
Task 5-6 – Lake Michie Embankment Stability Analysis	$12,000
Task 5-7 – Lake Michie Right Concrete Tailrace Wall Evaluation	$20,000
Task 5-8 – Lake Michie Spillway Stability Rehab Analysis and Evaluation of Alternatives to Meet Stability Criteria	$108,000
Phase 6 – Little River	
Task 6-1 – Little River Embankment Seepage and Stability Analysis	$14,000
Task 6-2 – Little River Gate Operation and Flooding Analysis	$19,000
Task 6-3 – Little River Spillway Concrete Pier Condition Evaluation and Repair Plan	$5,000
Task 6-4 – Little River Tunnel Quarterly Inspections	$11,000
TOTAL ESTIMATED FEE:	$610,000

This fee is for the specific scope of services detailed herein. If additional services are requested and authorized by CITY approval and a new executed Amendment, then additional fees will be charged. The fee for this additional work, or for work requested beyond the scope of services included herein, will be based on our current unit prices at the time the work is performed. Charges for these additional services will be an amount equal to the: 1) applicable ENGINEER personnel rates multiplied by the time expended by the personnel on this project; and 2) all non-personnel costs, including unit-rate charges, plus fifteen percent. Costs for subsequent phases, if required, will be provided and agreed under a new Amendment prior to beginning the additional work.

[SIGNATURES APPEAR ON FOLLOWING PAGES]

By signature, the parities accept the provisions of this Amendment No. 1 and authorize the Engineer to proceed at the direction of the City's representative.

ATTEST **CITY OF DURHAM**

By: _____ By: _____

Finance Officer:

SCHNABEL ENGINEERING SOUTH, PC
ATTEST

By: _____ By: _____(SEAL)
_____,Secretary _____ President

State of _____ ACKNOWLEDGMENT BY CORPORATION

County of _____

I, a notary public in and for the aforesaid county and state, certify that _____ _____ personally appeared before me this day and stated that he or she is _____ Vice President of Schnabel Engineering South, PC, a corporation, and that by authority duly given and as the act of the corporation, the foregoing contract or agreement with the City of Durham was signed in its name by its _____ President, whose name is _____, sealed with its corporate seal, and attested by him/herself as its said Vice President. This the _____ day of _____, 20_____.

My commission expires: _____
_____ Notary Public